Volume 15 January, 1929 *Number 1*

Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Essentials
of
Lubrication in the
Woodworking Industry

PUBLISHED MONTHLY BY
THE TEXAS COMPANY
TEXACO PETROLEUM PRODUCTS

Texaco Recommendations *for* Saw Mill Machinery

POWER PLANT

Steam Cylinders		
Saturated steam	above 150°	TEXACO PINNACLE CYLINDER OIL
	below 150°	TEXACO OLYMPIAN CYLINDER OIL
Superheated steam		TEXACO 650 T CYLINDER OIL
Air Cylinders		TEXACO ALCAID OIL OR TEXACO ALGOL OIL
Cup Leathers		TEXACO MARFAK GREASE No. 1
Bearings of Engines and Compressors		
Oil Lubricated	Drip feed	TEXACO ALEPH OR ALTAIR OIL
	Automatic circulation	TEXACO CANOPUS OIL OR TEXACO ALCAID OIL
Reduction Gears on Auxiliaries		
Where exposed		TEXACO CRATER COMPOUND No. 1 OR No. 2.
Where bath lubricated		TEXACO THUBAN COMPOUND
Driving Chains		
Where housed		TEXACO THUBAN COMPOUND B
Where exposed		TEXACO THUBAN COMPOUND

MILL MACHINERY

Chain Drives	
Transfer chains to slides	TEXACO CRATER COMPOUND No. 1 OR No. 0
For under-water operation	TEXACO CRATER COMPOUND X
Reduction Gears	
Where exposed	TEXACO CRATER COMPOUND No. 1
Where enclosed, to enable bath lubrication	TEXACO THUBAN COMPOUND
Where drip lubricated	TEXACO THUBAN COMPOUND B
Worm drives	TEXACO 566 GEAR OIL

Bearings

Plain or Sleeve Type		
Ring oiled type as used on motor drives		TEXACO CANOPUS OIL
Drip Lubricated	wick oilers	TEXACO ALEPH OIL
	sight feed cups	TEXACO ALTAIR OIL
Grease Lubricated	by pin type cup	TEXACO CUP GREASE No. 00
	by pressure gun or spring type cup	TEXACO CUP GREASE No. 3
Anti-Friction Type		
Oil lubricated		TEXACO SPICA OR CETUS OIL
Grease lubricated		
high speed ball bearings		TEXACO SPONGE GREASE
heavy duty roller bearings		TEXACO MARFAK GREASE No. 1

See Inside Back Cover for Recommendations for Wood Finishing Machinery.

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Essentials of Lubrication in the Woodworking Industry

MODERN industry today is illustrative of the untiring efforts of the engineer and scientist in the development of intricate machinery for the production of our comforts and luxuries. Our travels are expedited by the employment of mass production in the automotive industry; our pride and appearance are encouraged by the research of the textile colorist and the development of the high speed weaving and knitting machine; and our home, in all its beauty, is made possible by the studies of the woodworking expert, and the devious methods for turning out of beautiful furniture and cabinet work.

From the viewpoint of actual comfort and beauty as they pertain to our daily lives, the woodworking craft is of paramount interest. Without the motor vehicle we could revert to the horse, or walk; and color or texture in the matter of clothing is really not an essential to comfort, more nearly are they a question of style. But without the production capabilities of the planing mill or furniture plant, our home life might be severely limited.

It will therefore be of decided interest to study the more extensively used machinery involved in this essential industry, and especially to note the degree to which their economic production is dependent upon effective lubrication.

This latter may frequently present a salient problem in that the possibility of oil stains on finely grained woods must be continually guarded against. This will be particularly true where natural finishes are to be maintained, or where sand blast etching is practiced.

According to the Biennial Census of Manufactures, compiled by the U. S. Department of Commerce for 1925, there was a total of 3,472,770 primary horse-power involved in the lumber and allied products group of industries. It will furthermore be interesting to mention that from the viewpoint of horse-power involved, this group of industries is the fourth largest in the United States.

PROCESSES INVOLVED

In the manufacture of wood products, the first step after delivery of the raw material in the form of logs, to the sawmill, is to convert them into deals, boards or beams. For this purpose, circular or band saws are used.

Following this preliminary, the next step involves planing, moulding, shaping, etc., according to the purpose for which the finish is intended.

After sawing, these several processes are the most important in the woodworking industry. The operations involved are more or less similar, and frequently one machine can be designed to serve several purposes, such as, for example, the planing of two sides at the same time.

Planing

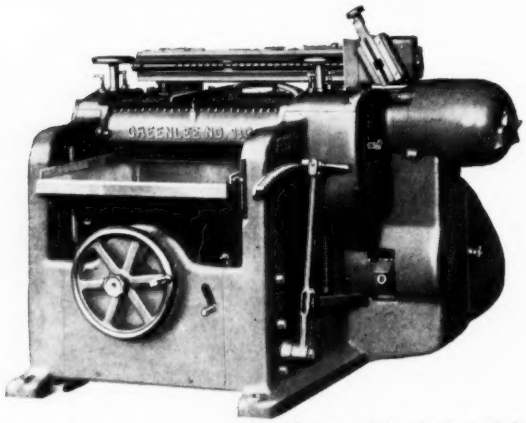
In the operation of planing, the purpose is to produce flat, level, and more or less smooth surfaces. Planers or jointers are constructed with a straight cutting edge in order to produce such surfaces, knives or cutters functioning continuously along a straight face, and generally as nearly parallel as possible to the grain of the wood.

It is also practicable to design planers for the creation of beading or grooving, although these

machines would more nearly come under the category of moulders.

Moulders

Where it is essential to develop ornamental work as involved in trim or moulding for building construction purposes, the principle of the multiple planer is brought into service. In the industry such machines are known as moulders or stickers. They are frequently designed to cut simultaneously on all four sides of the wood, developing either straight or irregular surfaces according to the desired finish. As in the planer, cutting is carried on at virtually a parallel with the grain of the wood.



Courtesy of Greenlee Bros. & Co.

Fig. 1—View of a six roll single planer equipped throughout with anti-friction bearings. The feed rollers are carried by Timken tapered roller bearings. Feed gears run in oil and are completely enclosed to exclude dust, chips and other abrasive foreign matter. High pressure grease lubrication is employed for all bearings outside of the gear cases.

Shapers

It has been further developed that irregular or curved edges along two planes can be produced by employing laminated cutters, for example. The general design of a shaper for the purpose of such work will be very much alike to a planer or moulder with the exception of the location and design of the cutters. Frequently these elements must function at an angle to the grain of the wood, oftentimes, in fact, across the latter.

Principles of Operation

It is interesting to state that regardless of the type of design or the purpose of the machine, there are but three basic principles involved, i.e.,

1. Where the cutters are fixed revolving spindles or holding blocks,
2. Where the cutters are carried or fixed in a rotating disc or crosshead, or
3. Where the irons are fixed only, the wood being moved or fed over the cutting or knife edge.

Mortising and Boring

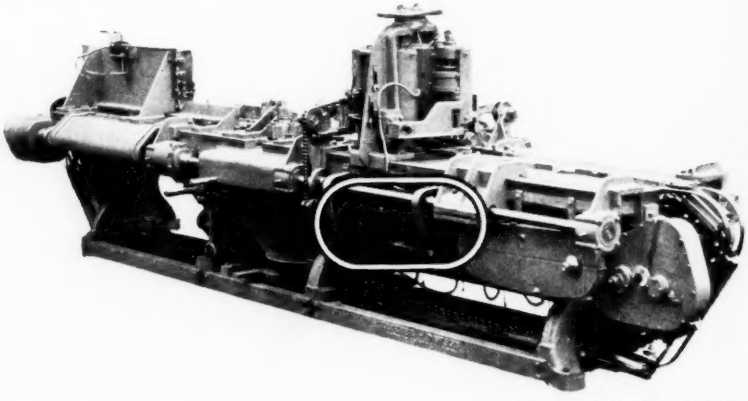
In the preparation of certain types of wood products, after sawing and planing to a true surface, it will be essential to prepare them for joining. An example of this would be a table or desk top. The machine used for this purpose is termed a mortise, or borer.

Cutting in such machines may involve either reciprocating or rotary motion, i.e., where the cutting tool or chisel operates intermittently or continuously. The essential purpose is to bore holes for dowel pins. In the woodworking industry today, boring is very largely a multiple operation, very much akin to the procedure of multiple drilling in the machine shop.

MEANS OF LUBRICATION

The means of lubrication in general use on modern sawmill and woodworking machinery are varied, according to the type and design of the wearing elements and the duty which they perform. Broadly speaking, there are five distinct types of lubricating equipment involved, viz.:

(a) The compression grease cup or pressure grease lubricator.
(b) The mechanical force feed oiler.
(c) The individual oil cup or sight feed oiling device.



Courtesy of Madison-Kipp Corp.

Fig. 2—View of a Klieber-Dawson automatic shaping moulder. Essential bearings of this machine are pressure oil lubricated by means of a Madison-Kipp force-feed lubricator. This device is shown in the oval at the center of the machine.

(d) The wick oiler, and
(e) Bath lubrication.

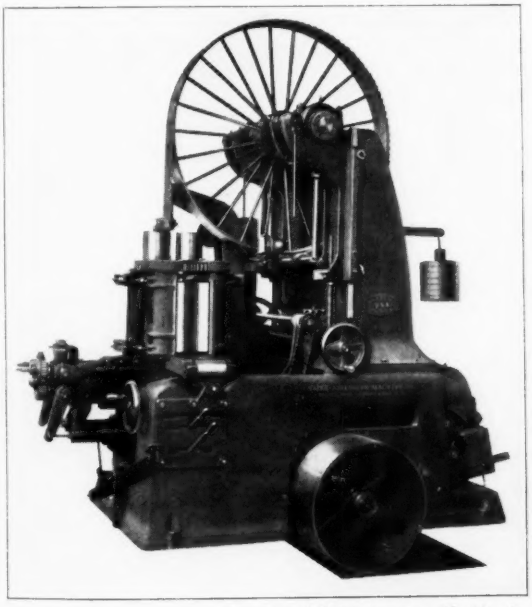
The first four of these systems or devices apply chiefly to bearing lubrication, although the individual or drip feed oiler is also used for application of somewhat heavier lubricants

than the average engine or machine oil to exposed gears or to certain types of driving chain installations.

Pressure Grease Lubrication

In the woodworking industry, pressure grease lubrication by means of the compression grease cup or pressure gun fitting, has been extensively adopted. This of course applies chiefly to bearings. Where these latter are of the anti-friction ball or roller type, it is the opinion of certain manufacturers of woodworking machinery that more accurate control of the amount of lubricant used can be attained by use of the hand-adjusted compression grease cup. This will be especially true where the operators of such machinery may not be entirely dependable in regard to the handling of a pressure gun.

It is important to remember in this regard, however, that there will very frequently be more possibility of contamination of grease with non-lubricating or abrasive foreign materials in filling a compression grease cup than where a pressure gun is used. As a general rule, the cap of the former must be entirely removed



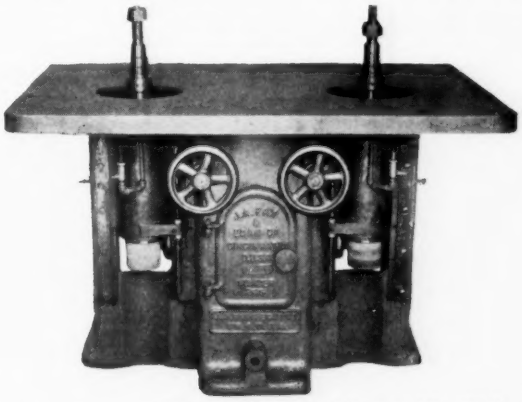
Courtesy of Yates-American Machine Co.

Fig. 3—Front view of a vertical band resaw. This machine is built with roller bearings as regular equipment. It is designed for belt drive, the speed depending upon the stock to be handled. Change feed gears are housed in a dust-proof gear box equipped with a removable lid, to provide ready access to the interior. This will enable bath lubrication of gears.

and filled by hand by means of a spoon or paddle which is dipped into the grease container. Should the machine be operating at the time, there might easily be a possibility of sawdust gaining entry or perhaps more abrasive dust or dirt. Furthermore, there is no assurance at any time that the operator or mechanic will observe the necessary care in protecting the lubricant as far as possible.

Contamination of Grease a Serious Matter

It can be readily appreciated that the result of any such carelessness would subsequently



Courtesy of J. A. Fay & Egan, and Gun-Fil Corp.

Fig. 4—A Fay & Egan machine equipped for pressure grease lubrication of certain of the bearings by means of automatic spring pressure grease cups. It is practicable to fill these cups by means of a grease gun through a standard pressure grease fitting. An indicator at the top of the cup will show the amount of grease contained therein at any stage of operation.

react upon the bearings, and in view of the fact that but a small amount of grease is applied to an anti-friction bearing, it will not take very much non-lubricating foreign matter to do perhaps quite a considerable amount of harm.

It is for this reason that many builders of anti-friction bearings prefer the use of the pressure grease gun even though accurate control of the amount of grease delivered by same may not be as easily attained. It should, however, not be a difficult matter to study any type of such gun and develop an approximate idea as to the amount of grease discharged per second or per turn of the handle, according to the design of gun.

If this study is further extended to include approximate knowledge of the amount of grease required by any such bearings according to their size, over-lubrication could easily be guarded against, with due care and attention on the part of the operator.

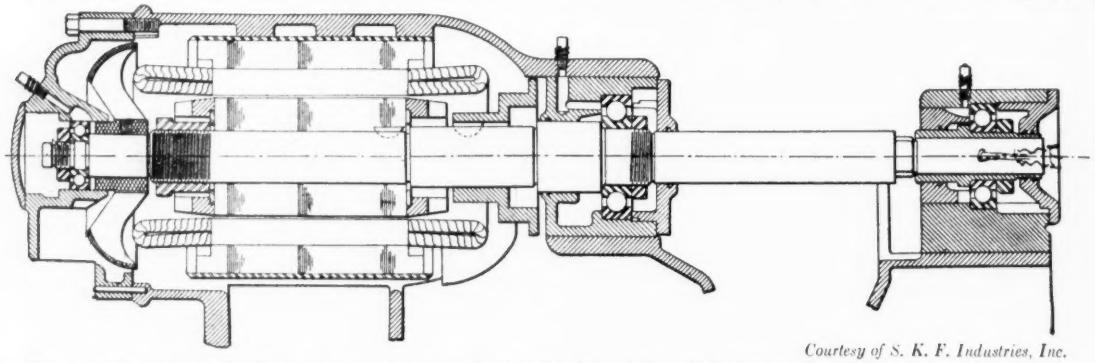
In a properly designed ball or roller bearing, complete replenishment of lubricant should only be necessary about once every three or four months, or perhaps at less frequent intervals if the housing is capable of holding a relatively large volume, and design and construction is such that an effective seal is maintained.

Grease Affords an Effective Seal

In regard to this matter of grease lubrication, it is advisable to note that greases as a general rule furnish better seals against the entry of

dust, dirt and moisture than do oils, thereby serving to protect the polished surfaces of the bearing elements in a very satisfactory manner. Greases can also be very much more effectively retained in a non-oil-tight housing.

On the other hand, dirt or grit that may find its way into a grease lubricated bearing has no means of settling out; it is always held in suspension, being probably carried back into the bearing repeatedly.



Courtesy of S. K. F. Industries, Inc.

Fig. 5—Illustrating the mounting design of a horizontal ball bearing spindle, with provision for pressure grease lubrication. This is brought about by direct application of a pressure grease gun through the fittings as shown adjacent to the ball bearings. Attention is drawn to the tightness of construction throughout, which effectively precludes entry of abrasive foreign matter, which might prove damaging to the bearings.

Anti-Friction Bearing Requirements

To most effectively meet the requirements involved a grease for anti-friction bearing service should:

1. Show no tendency to separate in storage or when inactive within a bearing. Nor should this occur under moderate heating.
2. There must be no tendency towards hardening or decomposition.
3. There should be no constituent contained therein which might lead to corrosion, pitting or rusting of bearing elements. As a result this would prohibit usage or accidental entry of sand, resin, salts or abrasives of any nature whatsoever.
4. Nor should there be any component which might tend to cause the lubricating film to become sticky or the grease itself to gum.
5. And finally, the consistency involved should be suited to the operating requirements.

As a general rule, greases which are comparatively light in consistency will meet average operating conditions where the lubricant must readily cover the entire surfaces of the balls or rollers and not tend to channel in the housings or raceways, as might occur with more viscous products of this nature which would have less of a penetrative ability.

Acidity Objectionable

It is extremely important, wherever ball or roller bearings are involved, that there be no tendency for a grease to show development of acidity during operation. It can be readily appreciated that a certain amount of corrosion can be expected from free fatty acids. As a result, in the presence of these the polished surfaces of the balls, rollers or their respective raceways might easily become pitted to such an extent as to materially interfere with effective operation and reduction of friction.

Of course, this may not hold true to the same extent for the stainless as for the plain steel bearing. This is a matter, however, which will necessitate study. Should it develop that stainless steels are not as extensively affected by free fatty acids as are plain steel bearing elements, the acidity requirement in greases for anti-friction bearing purposes might become of far less importance than it is today. Petroleum acids, on the other hand, are comparatively non-corrosive.

Mechanical Force Feed Oilers

For the lubrication of certain bearings which may be located in inaccessible positions on some types of woodworking machinery such as drum sanders, for example, it has been developed that the mechanical force feed oiler is a most positive means of assuring that oil will be delivered to a bearing or slide in just the right amount to maintain the necessary lubricating film, and under sufficient pressure to expel any contaminating foreign matter which may have accumulated in the oil ways.

Used Chiefly for Plain Bearings

The mechanical force feed oiler is chiefly used for plain bearing lubrication where bearing ends are not sufficiently sealed to assure retention of the oil, and where there is no provision for distribution of oil through the clearance spaces, other than pressure and the actual capillary attraction which is brought about by the rotation of the shaft or journal.

This means of lubrication is decidedly economical and positive, for it assures that

clean, fresh oil is delivered to the bearings at periodic intervals. Of course, there will be some oil waste through the exposed ends of the bearings, but by proper timing and adjustment of the lubricator, this amount will be so small and oftentimes so contaminated that its value will be comparatively negligible. Means should be provided, however, to catch any oil dripping that may be involved; otherwise, if allowed to drip on to other parts of the machine or to the floor below, a sloppy condition might be brought about to sometimes prove hazardous to the operators or detrimental to certain grades of wood wherein the grain might be spoiled or permanently marred by oil stains.

Oil must also be prevented from coming in contact with the rubber cushions of drum sanders, for this would lead to their ultimate deterioration.

Service Is Varied

The flexibility of the mechanical force feed oiler is clearly brought out by the duty which it is called upon to perform on the drum sander and rip saw, for example. On this latter the worm reduction gear, the cast iron links of the feed chain, and the ways or tracks over which this chain passes are served by one such lubricator.

Here the mechanical force feed oiler affords a practicable method of attaining positive lubrication with just the right amount of lubricant. This is of decided importance on finishing equipment, such as the drum sander.

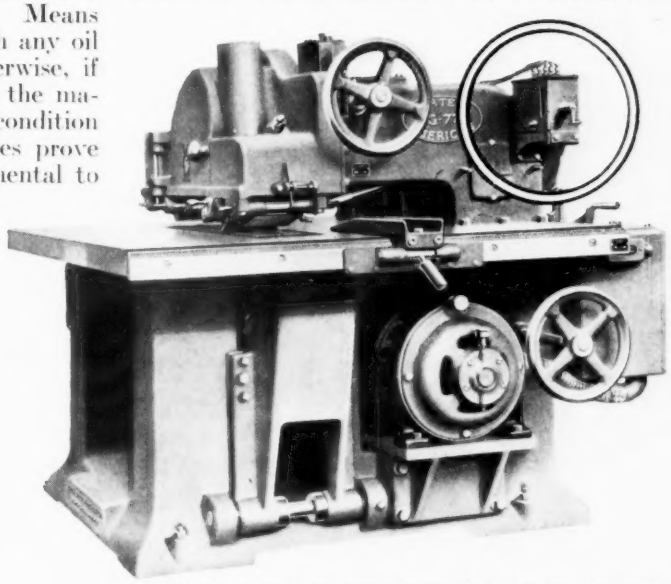
Manner of Drive

The mechanical lubricator has a further advantage in that once it has been filled with oil and the respective oil outlets adjusted for delivery of the desired number of drops of oil per minute, no further attention will be required. This is especially true where such a device may be driven directly from the machinery which it serves to lubricate. In such a case, the lubricator only operates or pumps when the machinery itself is in operation; i.e., the starting or stopping of the latter automatically starts and stops the respective pumps of the lubricator.

Control of Operating Speed

It is also interesting to remember that the speed of operation of the lubricator or, in other words, the number of drops delivered per minute through any of the outlets, can be made to depend upon the speed of the machine; that is, the higher the operating speed, the more oil will be delivered.

Where the lubricator is driven from an external source, as for example by an independent electric motor, it can be appreciated that more attention will be essential when starting and stopping the machine. On the other hand, this will normally be but a matter of opening or closing a switch.



Courtesy of Madison-Kipp Corporation and Yates-American Machine Co.

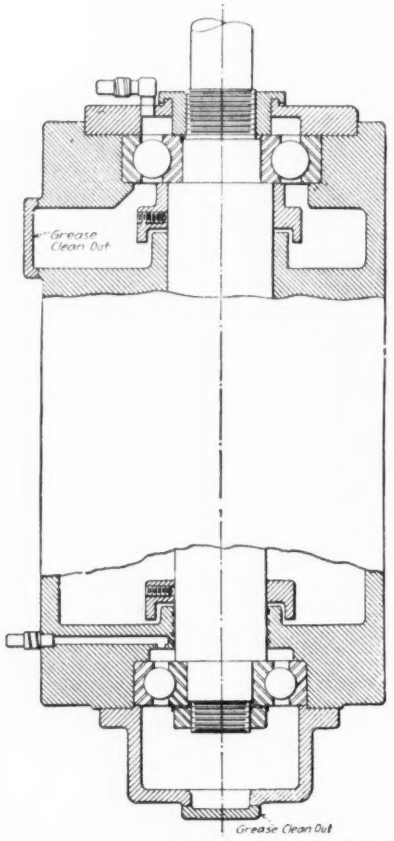
Fig. 6—A Yates-American jointing and ripping saw, equipped for oil pressure lubrication of the feed chains and V-ways under the chain feed bed. An adjunct of this method of lubrication is that delivery of oil starts and stops automatically with the feed. As a result, practically no attention on the part of the operator is required, and there is no chance of over-oiling. Other bearings on this machine are provided for pressure lubrication either by means of a pressure grease gun fitting or a screw-down compression grease cup.

It is important to mention, however, that where mechanical lubricators are independently operated, they may require more frequent adjustment should the operating speed of the machinery to be lubricated vary to any extent. Obviously, the higher this speed may be, the more oil should be delivered to the wearing elements to maintain the requisite film of lubricant. As a result, the speed of the lubricator driving element should be raised proportionately.

Constructional Details

From a constructional point of view, the mechanical force feed oiler will consist of a container or oil storage reservoir capable, as a general rule, of holding from one pint to two gallons of oil. The pumping element or block is located within this reservoir or attached thereto. In turn, this pumping element is provided with means whereby it can be attached to the machine to be lubricated or to an independent electric motor, through a suitable ratchet, clutch or belt connection.

There are a number of designs of lubricator pumps, depending of course upon the type of lubricator. As a general rule, however, they will all involve some form of plunger or piston. It is practicable to include quite a number of such pumps in the one lubricator in order to enable lubrication of as many as possible of the essential bearings, etc., from the one drive. It is furthermore practicable to divide such a lubricator into two or more parts so that more than one grade of oil can be delivered by the same device. As a general rule, however, this will not be so essential in the woodworking industry.



Courtesy of S. K. F. Industries, Inc

Fig. 7—View of a vertical spindle with provision for pressure grease lubrication. This is brought about by means of a grease gun. Note in particular the grease clean-outs provided adjacent to the top and bottom bearings, whereby old grease can be removed and the bearings completely flushed and cleaned prior to re-lubrication.

Operation of the pumping element is accomplished by means of an eccentric or a cam located within the oil reservoir. This device receives its motion through the exterior operating mechanism such as the ratchet. Each pumping unit can be designed to operate independently so that individual regulation is practicable. There is generally some provision in any such lubricator for observation of flow of oil either before or after it has passed through the pumping element. The purpose of this is, of course, to enable adjustment as to the amount delivered to the bearings, and also observation as to the extent to which oil delivery is being maintained.

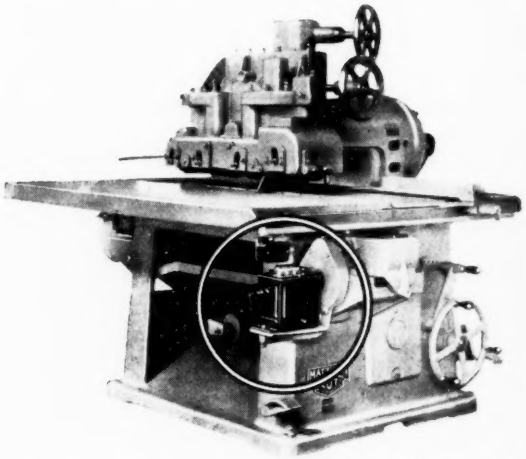
Individual Oil Cups

For the innumerable plain bearings of lesser importance on many types of woodworking machinery, the individual drip feed oil cup or adjustable sight feed oiler are extensively employed as the means of lubrication. These all embody the principle of the mechanical force feed lubricator, in that they deliver fresh oil to the bearings more or less periodically, according to their design.

The drip feed oil cup is also used for the application of comparatively fluid lubricants to certain types of exposed gearing, as has been discussed elsewhere in this article.

Drip Cups May Be Wasteful

From the viewpoint of initial expense, drip feed lubrication is comparatively low. In other words, the cups are cheap and easy to install. With the exception of the sight feed type, however, they are non-adjustable, oil flow being only controlled by the size of the orifice through which it is allowed to pass to the bearing. This may or may not lead to subsequent waste, according to the frequency of oiling. Where the orifice is comparatively large, and where the machine operator fills a cup full of oil without any thought as to the rapidity with which it will drain through the bearing, naturally the latter may receive far too much oil and waste may develop.



Courtesy of Madison-Kipp Corp.

Fig. 8—A combination jointer, edger and ripper, manufactured by Mattison Machine Works. Here again lubrication of feed chains and V-ways is brought about by means of a force-feed lubricator shown in the circle. On this particular machine, the chain itself can just be seen to the left of the lubricator, the saw blade is shown above the work table.

Sight Feed Oilers Can Be Adjusted

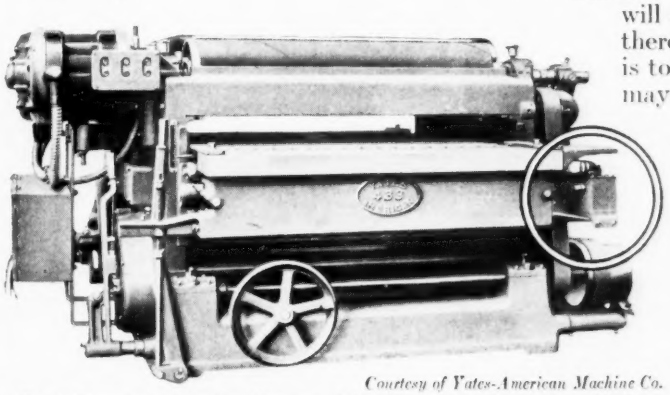
The sight feed oil cup, on the other hand, is capable of more accurate adjustment in regard to the rate at which the oil is allowed to flow through. On many types, there are also provisions for actually stopping the oil flow. This is especially advantageous when a machine is to remain inactive for any length of time, for otherwise oil would just run through the bearings, to be wasted.

Wick Oiling Devices

For the lubrication of certain types of antifriction bearings as, for example, on high speed vertical shaper spindles, wick oilers have been found to prove an extremely positive and cleanly means of insuring lubrication. The typical design of such a system involves continuous circulation of the oil through the bearings. In connection with the shaper as mentioned above, a small centrifugal pump is frequently employed, being located in the lower oil reservoir. This pump serves to feed oil to the upper ball bearing via a suitable wick. From here, the oil drains to the lower bearing reservoir to be distributed by a smaller wick. After passing through this bearing there is provision for the oil to return to the pump for re-circulation.

Wicks Function Also As Oil Filters

By the employment of wick feed lubrication the asset of oil filtration is attained. This assures that clean oil is continually delivered to the bearings.

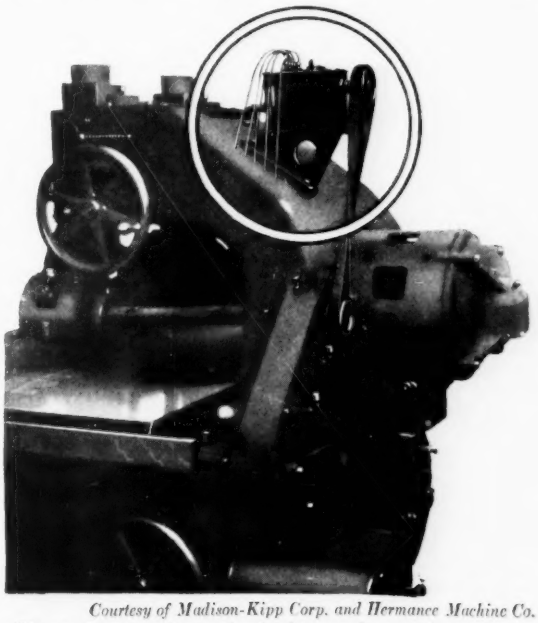


Courtesy of Yates-American Machine Co.

Fig. 9—Force-feed lubrication of the ways of the endless bed sander, through a Madison-Kipp mechanical oiler (shown at the extreme right). It is extremely important in a machine of this type, to prevent oil from coming in contact with the rubber cushions. The drum spindles of this machine are carried in ball bearings, which run in a continual bath of oil. Elsewhere on this machine oil cup or pressure grease lubrication is practised, according to the design and construction of the bearings or gears.

Wick feed lubrication, as applied to woodworking machinery, is practically automatic. However, this will not hold true over the entire life of the wick, because during continued operation, should there be any possibility of entry of dust or dirt into the lubricating oil, the wick will naturally accumulate this more and more until ultimately it may become so clogged as to prevent ready flow of oil.

As a result, wicks should be removed and cleaned at regular intervals, depending upon how extensively they may become contaminated. Flow of oil may also be influenced by the number of strands used in such a wick for this will affect capillary action. As a rule, if there are too many strands, or if the wick is too heavy or tightly woven, this action may be reduced.



Courtesy of Madison-Kipp Corp. and Hermance Machine Co.

Fig. 10—Top view of a combination jointer, edger and ripper, showing the mechanical force-feed lubricator in the oval. It can be seen that here this device is belt driven, the five oil leads carrying down through the top housing of the machine. Adjacent to the bottom driving pulley, can be seen a number of oil cups for the lubrication of auxiliary bearings.

The presence of any moisture may also affect this action. New wicks especially will tend to absorb moisture when exposed to the air. Moisture of course, is detrimental to capillary action inasmuch as it impedes the free flowing of oil. As a rule, wicks, when being installed new, or after cleaning, should be thoroughly saturated with oil prior to usage.

Siphonic Action May Also Be Involved

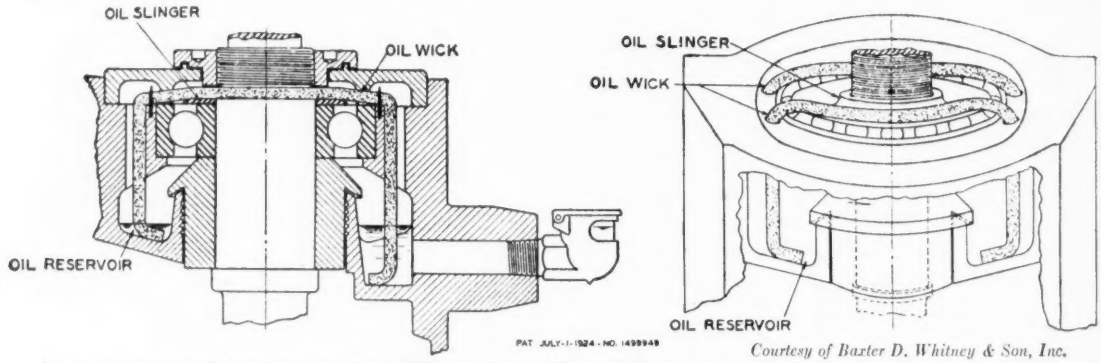
While mention has been made above to capillary action alone, it is important to remember that wick feed lubricators can also be designed to involve the action of the siphon, or a combination of both capillary action with the action of this latter.

Capillary action is involved in the up-feed type of lubricator, wherein the oil passes up-

ward through the strands of the wick of its own accord, motion of the journal or shaft being required to draw oil away from the uppermost part of the wick with which it is in contact. Wicks of the capillary type are automatic, even without a pumping element for the flow of oil automatically starts and stops with the starting and stopping of the rotating element.

Siphon type wicks, however, or those devices which involve both capillary attraction and the action of the siphon, must have some provision for starting or stopping the flow of oil. Otherwise, this latter will continue whether or not the shaft or journal is rotating. Where a pump is involved, however, when this stops the oil flow will stop likewise.

The extent to which oil may flow through the wick involving siphon action will depend upon the oil level below the wick, the number of strands involved, and the oil pressure upon the wick itself. All of these, of course, can be varied according to the lubricating requirements of the bearing. As a result, with due study, such means of lubrication can be made decidedly economical. They may, however, require some provision in the form of a shut-off or stop-cock in the oil distributing line, to prevent loss of lubricant when they are not required to function.



Courtesy of Baxter D. Whitney & Son, Inc.

Fig. 11—Showing the lubrication system for the Whitney shaper. Note that this is a means of oil lubrication of the ball bearings by means of a suitable wick as shown. The oil reservoir is also shown below the bearing itself. In order to enable constant control of oil level, an oil cup over-flow is installed as shown in the figure to the left. This device will effectively prevent any possibility of over-lubrication by carrying too much oil in the reservoir.

Bath Lubrication

On some types of woodworking machinery, construction will be such that certain of the driving gears especially will be located in an oil-tight housing. Under such conditions it will be practicable to operate the gears in a bath of lubricant. This is a most excellent method of insuring that the gear teeth will be constantly protected by an adequate film of lubricant of the proper viscosity to prevent wear and noise as far as possible. Furthermore, but very little attention will be required. In fact, such an installation is analogous to the driving gears of an automobile wherein, provided that the proper lubricant is originally chosen, continued and efficient operation can be depended upon for extended periods of time.

Cleanliness a Factor

The use of an oil-tight gear case is also conducive to cleanliness and to protection of the lubricant contained therein against contamination by sawdust or other non-lubricating foreign matter.

As a general rule, where such construction is involved, it has been found advisable to use a compound lubricant verging on the nature of a light solid grease.

There may frequently be conditions where apparently high shock must be withstood by the gear teeth as they pass into mesh with each other. These conditions are of course best met by a lubricant wherein the mineral oil constituent is of adequate viscosity to form and maintain a comparatively thick lubricating film. This latter, however, should not be so adhesive as to impose an abnormal drag, with increased power consumption, especially when the machine must be put into operation under comparatively low temperatures.

Noise an Indication of Imperfect Lubrication

It is advisable to mention at this point, in this discussion of gear lubrication, that virtually the only way of determining whether effective lubrication is being maintained is to observe the extent to which noisy operation may occur. It is almost impossible to use the temperature of the gear case as a criterion, as is practicable where bearings are involved. With these latter, of course, any development of abnormal metal-to-metal friction will frequently be indicated by an increase in temperature which can oftentimes be felt by the hand unless, of course, the bearings are inaccessible or so located as to render it a hazard to touch them.

In a gear case, on the other hand, there is so much more space available, as a general rule, that any heat which might be developed through actual metallic contact between gear teeth would probably be dissipated before it has a chance to pass to the exterior of the case.

However, should such metallic contact be occurring there would be considerably more noise and clanking between the teeth than would prevail in event of their being properly lubricated. Noise of this nature should therefore be taken as an indication of the fact that a condition of faulty lubrication exists, and steps should be taken to correct same.

Method of Correction

The normal procedure in such a case would be to open up the gear box and flush out all used lubricant, cleaning the teeth as far as possible with a comparatively light machine oil or flushing oil. At the same time, of course, the extent to which wear has been occurring can be observed. If this has not gone too far, the next step would merely be to add a fresh charge of gear lubricant, of the characteristics mentioned above, and proceed with operation.

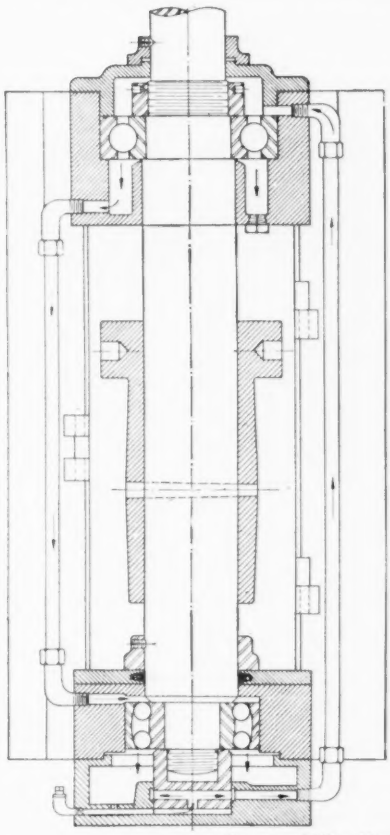
Generally speaking, however, even though there is no indication of an extensive amount of noise, it will be advisable where a machine has been in continued operation comparatively steadily, to clean out all such gear cases about twice a year.

Courtesy of The Fafnir Bearing Co.

Fig. 12—Side view of a Tannewitz band saw equipped with a Lincoln electric motor for driving purposes. The saw wheels are carried in ball bearings. Note that means for pressure grease lubrication is provided for on the electric motor.

Lubrication of Exposed Gears

The manner in which driving gears are installed in the average woodworking machine will vary according to the duty involved. Where it is practicable to enclose such gears in a relatively tight housing, bath lubrication, as above, will normally be the best procedure.



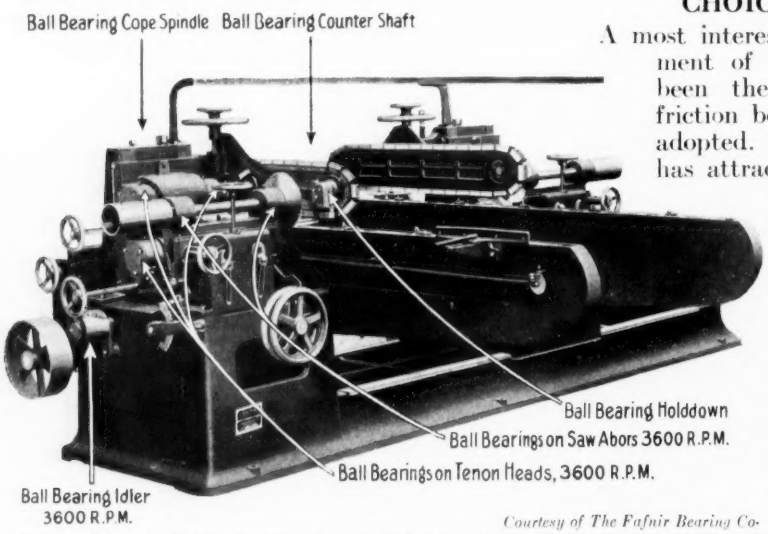
Courtesy of Oliver Machinery Co.

Fig. 13—Detailed view of the Oliver shaper spindle. Note that this is carried by ball bearings with provision for oil lubrication by means of a suitable pump located at the lower end of the cylinder. This pump delivers oil from the bottom of the lower bearing to the top of the upper bearing. This oil then passes through the rolling elements and back to the pump for re-circulation. Flow of oil is indicated by arrows. Note that an oil level control is provided at the base of the cylinder. Pressure circulation of oil in this manner provides an extremely efficient means of insuring effective lubrication.

Such a means of lubrication is usually decidedly protective, and quite economical, for there will be but little chance for loss of lubricant through leakage, etc., or for contamination on account of entry of sawdust or other non-lubricating foreign matter. In such cases, the choice of a suitable gear lubricant should entail no difficulty, for the essential problem in hand will be to study the installation with a view to obtaining a product of just the right body to meet the gear tooth pressures, and an ability to maintain a protective film on the tooth surfaces to withstand the effects of squeezing out.

Where gears are exposed, on the other hand,

the problem of protecting the wearing surfaces of the teeth may become more difficult; it will depend, however, upon the location of the gears and whether they constitute a feed, drive or adjusting mechanism.



Courtesy of The Fafnir Bearing Co.

Fig. 14—View of a Jenkins Machine Company belt driven double-end tenoner. The location of the essential ball bearings on this machine are shown by arrows. It is also interesting to note the speeds of certain of these elements.

The Question of Adhesiveness

In the case of exposed gears the essential factor is to select a lubricant which will adhere tenaciously to the teeth and resist the throwing-off effects of centrifugal force. On certain types of woodworking machinery, however, the matter of sawdust must be taken into account. Sawdust, of course, is non-lubricating. If, therefore, it has a chance to become mixed with certain types of gear lubricants, these latter, by virtue of their retentive ability, may accumulate so much sawdust as to cause balling-up. The normal consequence will be a congested condition which may extend to the bearings to subsequently hamper their lubrication as well.

It is for this reason that the more adhesive types of strictly gear lubricants are not always as satisfactory for such gears, as are those more fluid machine oils which can serve to keep the gear elements free from accumulation of sawdust by virtue of their washing action.

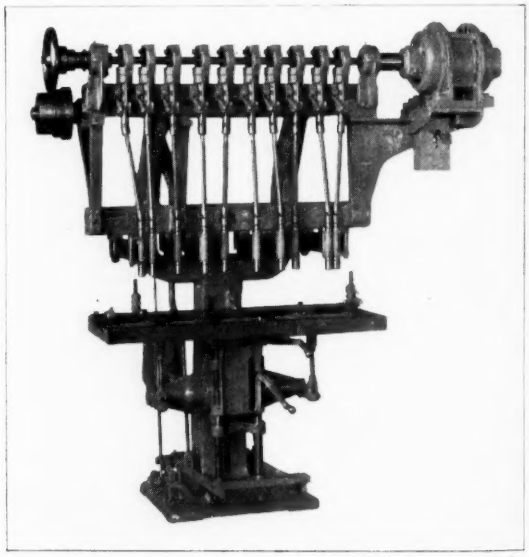
This latter action, however, will involve the necessity of suitable drip pans in order to prevent a sloppy and hazardous condition around the machine.

It is furthermore difficult to practice oil economy where lubricant is used in this manner. However, oil economy, while important, must frequently give way to machine protection and the more outstanding essential of continuous production. Fortunately, the gears whereon such means of lubrication may be necessary are of comparatively small size, and not subjected to an appreciably severe load or shock during operation. In many cases, they have the added advantage of intermittent operation.

CHOICE OF BEARINGS

A most interesting feature in the development of woodworking machinery has been the extent to which the anti-friction bearing has been studied and adopted. The ball bearing especially has attracted attention in this regard where high-speeds must be developed. It is pertinent to state that it is customary to operate some elements as high as 10,000 r.p.m. today, with comparatively positive operation where effective lubrication is maintained.

For lower speed service in turn, the roller bearing has been found to prove especially adaptable, particularly where fairly heavy duty may be involved. An example of such a combination of bearings is the electrically operated planer and matcher, wherein all cutting heads and feed rolls run in ball bearings, with gear shafting carried by roller bearings.



Courtesy of Greenlee Bros. & Co.

Fig. 15—A universal spindle vertical gang borer. In view of the fact that it is essential for this machine to be capable of quick adjustment and grouping of spindles in order to conform to the nature of the work to be performed, it is essential that it be capable of the most extreme accuracy. Ball bearings will enable operation with a minimum of wear and are extensively used on the spindle drive shaft of this equipment. Also, the upper and lower sections of the spindles run in ball bearings to insure permanent accuracy. The driving gears are housed as a unit.

On many other machines roller bearings of the tapered or flexible type are also extensively

employed for certain of the heavier, slower speed elements, such as the bearings of speed reduction gears.

Speed, Bearing Design and Duty the Factors

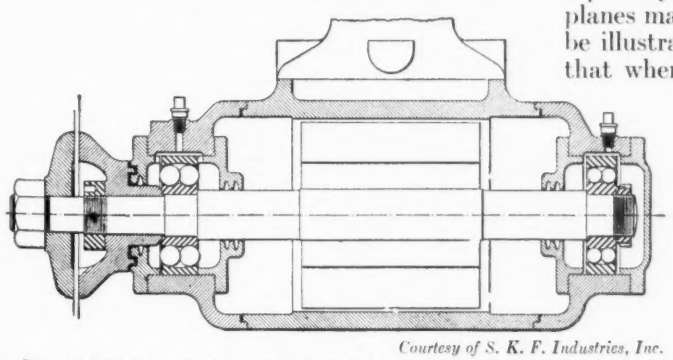
In the choice of means of lubrication, the matter of speed and bearing design have apparently been given equal consideration, along with the severity of the duty involved. There has, however, been no attempt to draw a real line between high speed and low speed service.

In this regard, the modern practice in construction of such equipment as a planer, moulding machine or surfacer will be of interest. Here there is a rapidly increasing tendency to provide ball bearings for all knife head or cutting elements. Incidentally, these parts rotate at comparatively high speed, varying from 3000 to 7000 r.p.m., according to the design of the machine.

In contrast, however, the plain or sleeve type bearing is chiefly used for shafting of guide rollers or similar elements where the load involved may not be as severe.

The same will hold true in saw design. Normally the band, swing or circular saw is a comparatively low speed device. In the band saw, motion is imparted by an upper and lower disc or wheel. Around these elements, the saw band is tightly stretched. Such saws are chiefly operated by individual motor drives, the electric motor being located below the saw bench and connected directly to the lower saw carrier.

The average saw in the sawmill proper is a heavy duty machine, and it must be capable of withstanding high loads and severe shocks.



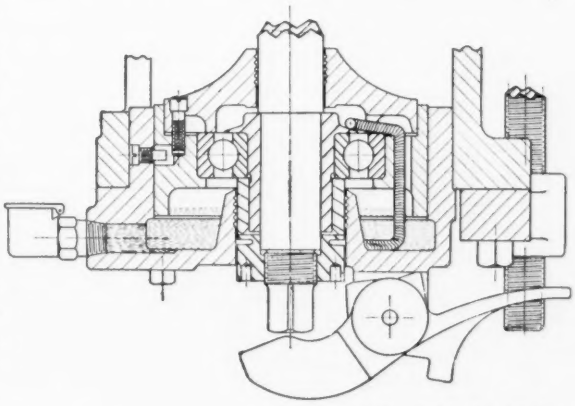
Courtesy of S. K. F. Industries, Inc.

Fig. 16—Bearing design for a direct driven swing saw. On equipment of this nature, where entire movement of the bearing element may be necessary, it has been found that grease lubrication is preferable to oil, due to the fact that this latter might become subject to surging on account of the motion of the saw. In order to prevent leakage of lubricant, note that the bearing housings on the inboard side are provided with labyrinth type of seals.

In the woodworking plant, however, where so-called re-sawings or cut-off work is practiced, conditions of operation will not be as severe, and frequently saw speeds may be somewhat higher.

Effective Lubrication Assures Mass Production

It is of course obvious that in the operation of any woodworking machine, positive operation must be assured, for mass production in this industry has come to be virtually a by-word, and the custom in every phase of operation.



Courtesy of The Fafnir Bearing Co.

Fig. 17—A ball bearing housing for a high speed vertical shaper spindle. Note that this is an oil lubricated device, employing wick feed for delivery of oil from the reservoir to the top of the bearing. A distinct advantage of using a wick for this purpose involves filtration of oil. In consequence, clean oil is constantly delivered to the bearing. Another feature of this system of lubrication is that oil is delivered by the wick only when the shaft is turning. As a result, there is no possibility of oil loss. To the left of the housing is shown an oil over-flow control by means of which a constant level of oil in the reservoir can always be maintained. This device can also be used as a means of cleaning and re-lubricating the bearing.

To bring this about, pressure grease lubrication, as already stated, is extensively employed on many of the ball and roller bearings in the woodworking industry. Grease is especially adaptable where operation in various planes may be required. The swing saw would be illustrative of this condition. It is obvious that where oil is used on such bearings there may be a possibility of inadequate lubrication, when the bearings are located in certain positions due to the oil level falling below the circulating element. Where such bearings are designed to operate in a fixed plane, however, oil lubrication by means of wick circulation has proven quite positive and satisfactory.

Oil Level Control

It is interesting to state that it is easier to control the amount of lubricant in such a bearing where oil is used than where grease is employed. This is, of course, brought about by means of an accessory oil cup as indicated in Fig. 17. A simple type of oil cup, inserted as shown, renders it virtually impossible to

raise the oil level above the top of the cup, due to the overflow tendency. An overflow or oil level control is especially desirable where wick feed lubrication may be involved, for it will prevent any possibility of abnormal oil leakage from the bearing.

Every precaution is taken today by the manufacturers of anti-friction bearings to prevent loss of lubricant by leakage. This can be brought about by the employment of grooving or by the use of suitable felt washers. This construction, of course, will also serve to prevent entry of contaminating or abrasive foreign substances.

In this regard, it is interesting to state that grease will, as a rule, serve as a more effective bearing seal than will oil. It must be borne in mind, however, that grease will tend to retain non-lubricating foreign matter to a considerable degree, although this will, of course, depend upon the consistency of the grease.

CONCLUSION

In view of the extensive variety of equipment involved in the woodworking industry, and the many functions which must be performed by this machinery, it has been deemed advisable to confine this article on lubrication strictly to a discussion of the design of the wearing elements and the means of lubrication involved.

Comparatively little space has been devoted to discussion of the operations and the machinery as a whole. It is felt, however, that the illustrations which have been chosen to accompany this article will be far more helpful to the reader than could any extensive description of the duties which must be performed. With this object in mind, these illustrations have been captioned accordingly.

The further advantage pertaining to these illustrations is that in almost every instance they show the means provided for lubrication, and in some cases, the actual design and construction of the wearing elements.

The woodworking industry, with the cooperation of certain of the bearing manufacturers and builders of lubricating equipment, has developed the art of lubrication to an extremely high degree. As a result, if the operator of virtually any type of sawmill or woodworking machinery enlists the cooperation of the manufacturers of lubricating oils and greases, who have a reputation for dependability, there is no doubt but that he can carry on the lubrication of his machinery in a most effective and economical manner.

It is our hope that even though this article may have touched but the high-spots of this most important detail in the operation of woodworking machinery, the information which we have given will lead to a better understanding of the means of lubrication which have been proven adaptable, and the lubricating requirements of the average plant.

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